

(12) **United States Patent**  
**Aoki et al.**

(10) **Patent No.:** **US 9,193,432 B2**  
(45) **Date of Patent:** **Nov. 24, 2015**

(54) **STRATOSPHERIC STAY FACILITY**

(56) **References Cited**

(75) Inventors: **Takahira Aoki**, Tokyo (JP); **Yasuyuki Miyazaki**, Funabashi (JP); **Ryoji Sakai**, Sakai (JP); **Yoshiko Yoneyama**, Tokyo (JP)

U.S. PATENT DOCUMENTS

282,060 A \* 7/1883 Debayeux ..... 244/73 R  
691,719 A \* 1/1902 Greth ..... 244/33  
(Continued)

(73) Assignee: **SAKASE ADTECH CO., LTD.**, Sakai-shi, Fukui (JP)

FOREIGN PATENT DOCUMENTS

DE 4431576 A1 3/1996  
DE 20 2007 007 652 U1 9/2007

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(Continued)

OTHER PUBLICATIONS

(21) Appl. No.: **13/876,342**

Graham Warwick, "Higher Ground: Stratospheric airships special report", Flight International, Aug. 15, 2006. Accessed from <http://www.flightglobal.com/news/articles/higher-ground-stratospheric-airships-special-report-208385/> on Jun. 20, 2014.\*

(22) PCT Filed: **Sep. 28, 2010**

(Continued)

(86) PCT No.: **PCT/JP2010/066858**

§ 371 (c)(1),  
(2), (4) Date: **Jun. 24, 2013**

*Primary Examiner* — Tien Dinh  
*Assistant Examiner* — Alexander V Gicz

(87) PCT Pub. No.: **WO2012/042600**

(74) *Attorney, Agent, or Firm* — Westerman, Hattori, Daniels & Adrian, LLP

PCT Pub. Date: **Apr. 5, 2012**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2013/0264413 A1 Oct. 10, 2013

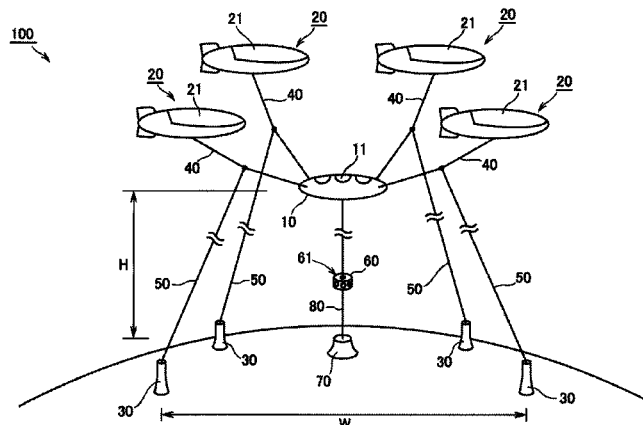
There is provided a stratospheric stay facility that allows humans to stay in the stratosphere in the altitude range of 15 to 25 kilometers. The stratospheric stay facility includes a structure for stay **10** having a cabin in which an environment allowing humans to stay in it is maintained and having resistance to pressure in an environment at a highest altitude at which the structure for stay is kept flying, airships **20** that are adapted to be capable of ascending to the sky by buoyancy and lifts the structure for stay **10** to keep it flying in the stratosphere in the altitude range of 15 to 25 kilometers, and first mooring cables **50** and second mooring cable **80** each of which has a first end fixed to the structure for stay **10** and a second end fixed to the ground to moor the structure for stay **10**.

(51) **Int. Cl.**  
**B64B 1/50** (2006.01)  
**B64B 1/30** (2006.01)

(52) **U.S. Cl.**  
CPC .... **B64B 1/50** (2013.01); **B64B 1/30** (2013.01)

(58) **Field of Classification Search**  
CPC ..... B64B 1/02; B64B 1/60; B64B 1/22;  
B64B 1/40; B64B 1/50; B61B 7/00; B64C  
37/02  
USPC ..... 244/24–33, 96–99, 115–116, 125–128  
See application file for complete search history.

**16 Claims, 6 Drawing Sheets**



(56)

**References Cited**

## U.S. PATENT DOCUMENTS

889,693	A *	6/1908	Lake	244/30
2,950,881	A *	8/1960	Schwoebel	244/31
4,085,912	A *	4/1978	Slater	244/25
4,581,897	A *	4/1986	Sankrithi	60/641.12
5,857,654	A *	1/1999	Berman	248/441.1
6,224,015	B1 *	5/2001	Reinhard	244/24
6,422,506	B1 *	7/2002	Colby	244/1 TD
2001/0002686	A1	6/2001	Yokomaku et al.	
2002/0109045	A1 *	8/2002	Beach et al.	244/33
2002/0167702	A1 *	11/2002	Badesha et al.	359/172
2009/0152391	A1 *	6/2009	McWhirk	244/30
2009/0184196	A1 *	7/2009	Price	244/33

## FOREIGN PATENT DOCUMENTS

JP	05-0007600	U	2/1993
JP	2000-095196	A	4/2000
JP	2001-199397	A	7/2001
JP	2010-202148	A	9/2010

## OTHER PUBLICATIONS

L. David, R. Citron, T. Rogers & C. D. Walker, Apr. 25-28, 1985, "The Space Tourist", AAS 85-771 to -774. Proceedings of the Fourth

Annual L5 Space Development Conference held Apr. 25-28, 1985, in Washington, D.C. Accessed from [http://www.spacefuture.com/archive/the\\_space\\_tourist.shtml](http://www.spacefuture.com/archive/the_space_tourist.shtml) on May 2, 2014.\*

Gregory Kennedy, "Stratolab, an Evolutionary Stratospheric Balloon Project", page generated Nov. 25, 2008. Accessed from <https://web.archive.org/web/20090813113949/http://stratocat.com.ar/artics/stratolab-e.htm> on Jun. 23, 2014; date of archival Aug. 13, 2009.\*

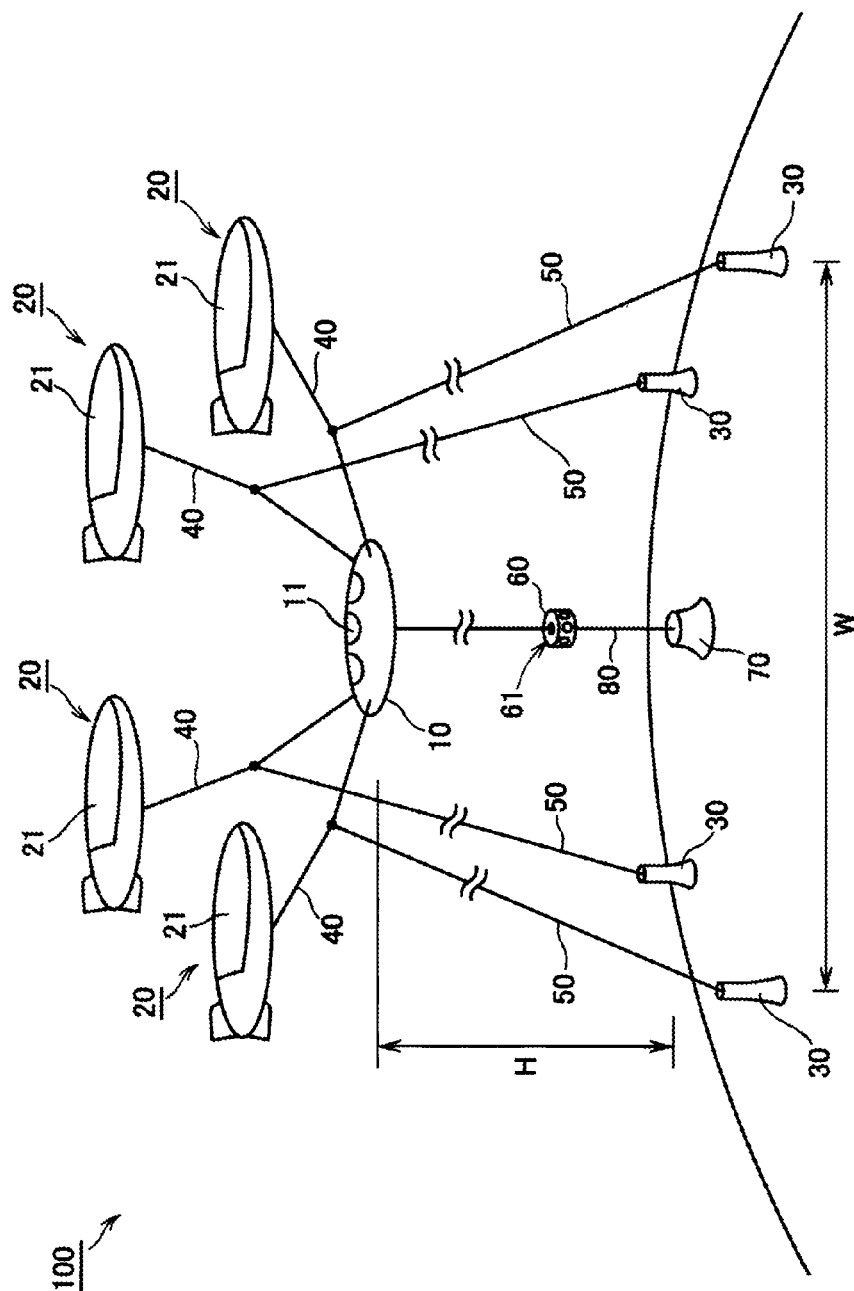
Ahmed Khairy Noor, Samuel L. Venneri, "Future Aeronautical and Space Systems," AIAA, 1997, p. 239. Accessed from <http://books.google.com/books?id=uuR5yBwvhsQC&pg=PA239&dq=tethered+stratospheric+airship&hl=en&sa=X&ei=UNKoU-CaN9TesASpn4CgBQ&ved=0CCAQ6AEwAQ#v=onepage&q=tethered%20stratospheric%20airship&f=false> on Jun. 20, 2014.\*

Global Near Space Services, "What is Near Space?", <http://www.globalnearspace.com/definition.shtml>, accessed Sep. 2, 2014. Archived by the Internet Archive on Feb. 16, 2009, <https://web.archive.org/web/20090216173027/http://globalnearspace.com/definition.shtml>, accessed Sep. 2, 2014.\*

International Search Report of PCT/JP2010/066858, mailing date of Oct. 26, 2010.

Office Action dated Apr. 4, 2015, issued in corresponding German Patent Application No. 11 2010 005 912.8 with English translation (9 pages).

\* cited by examiner



١٥٠

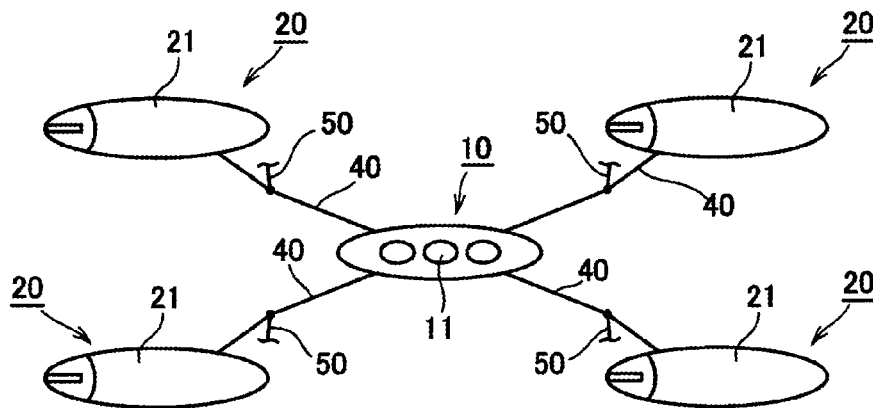


Fig. 2

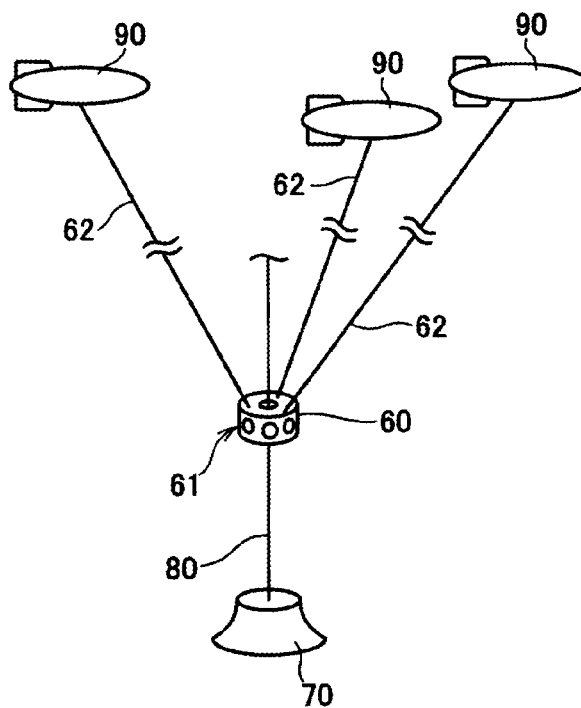


Fig. 3

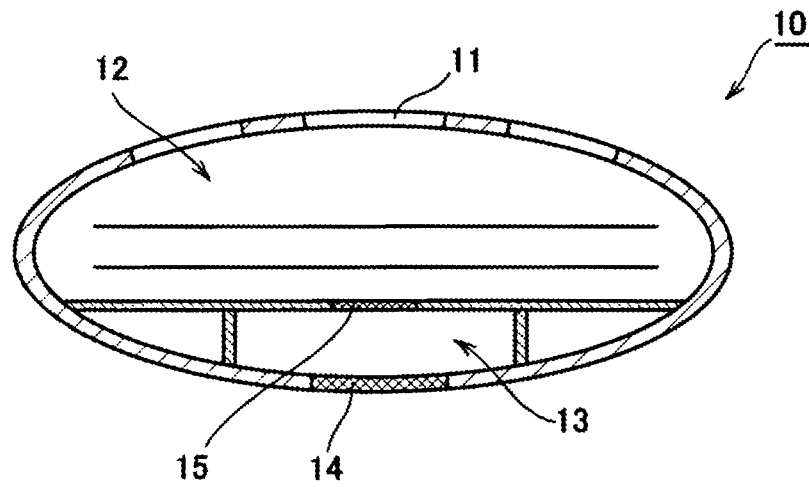


Fig. 4

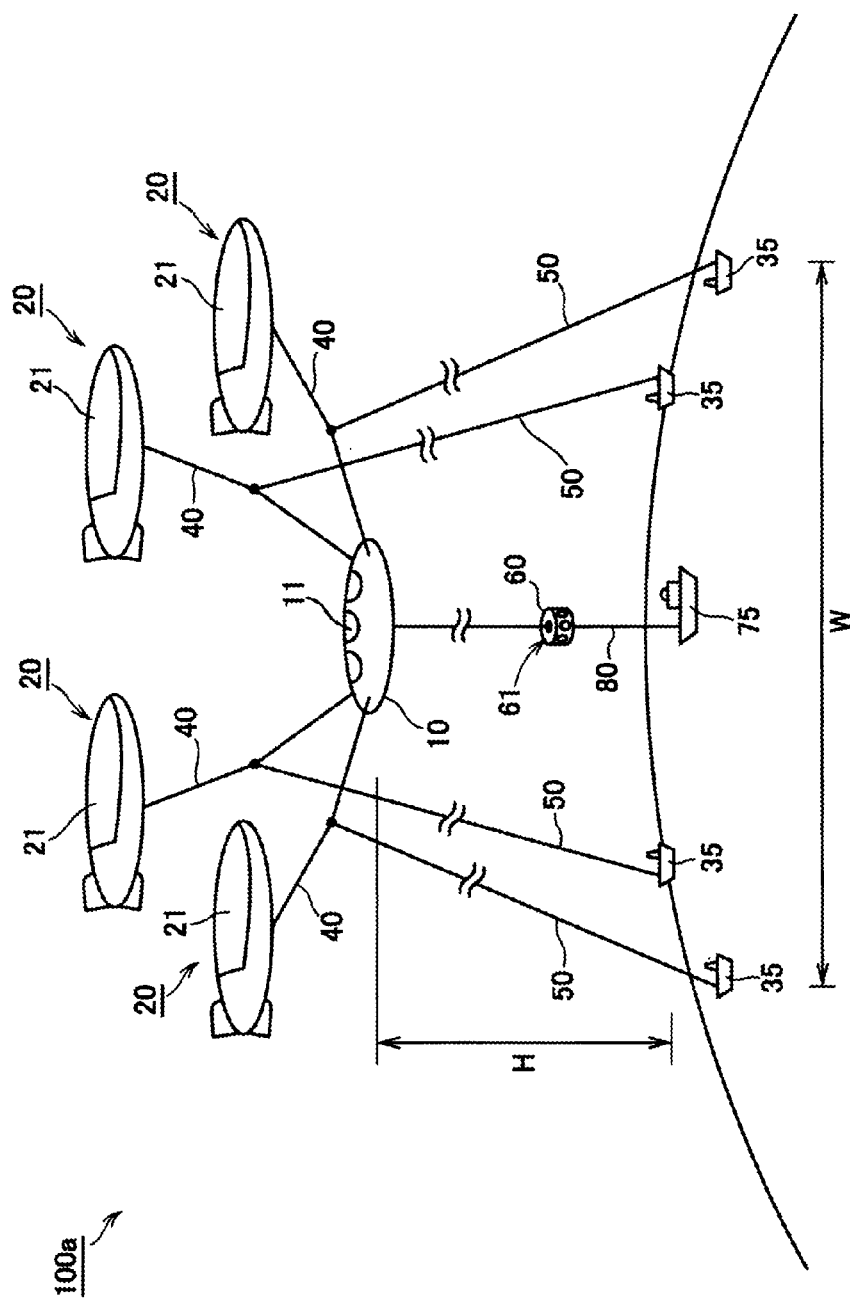


Fig. 5

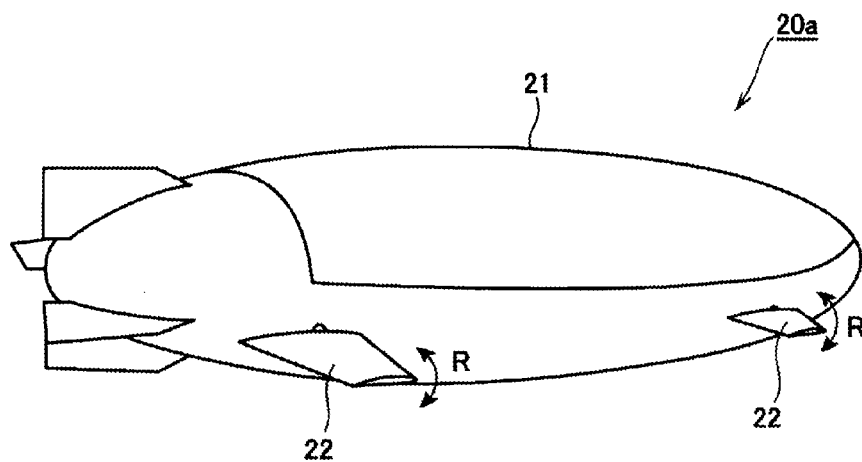


Fig. 6

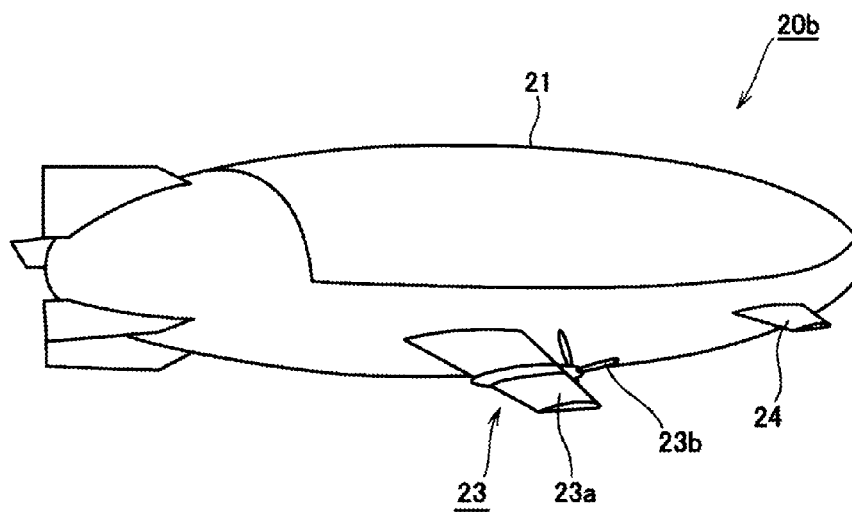


Fig. 7

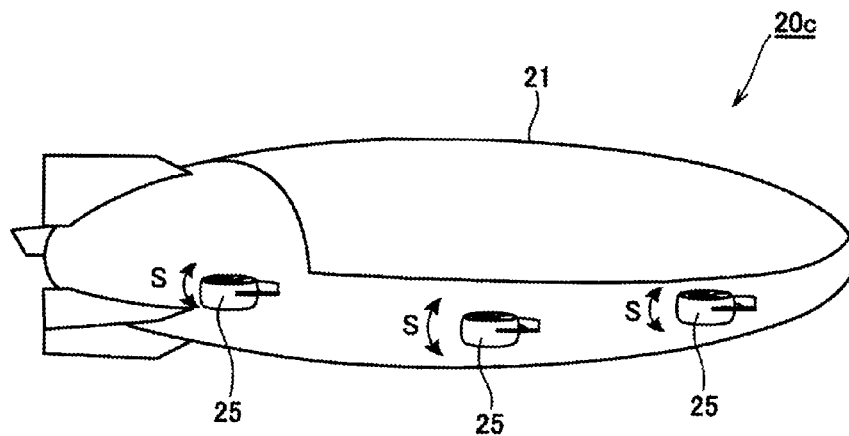


Fig. 8

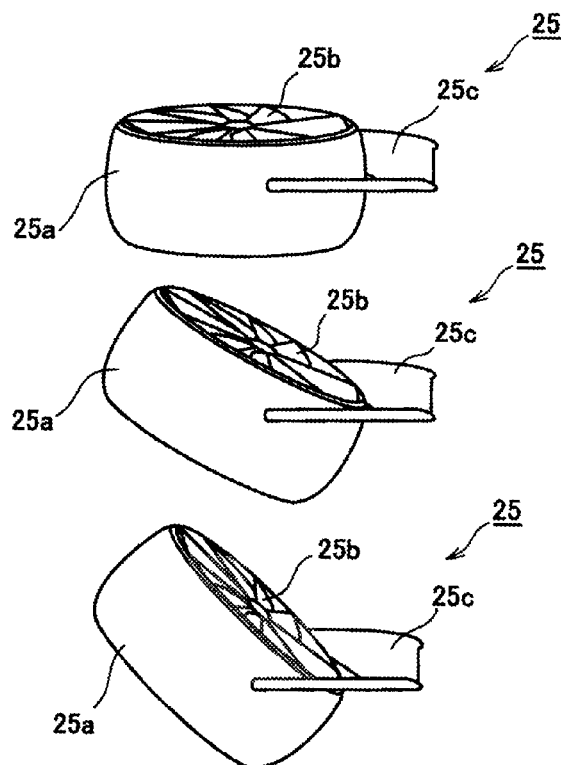


Fig. 9



1

**STRATOSPHERIC STAY FACILITY****TECHNICAL FIELD**

The present invention relates to a stratospheric stay facility that allows humans to stay in the stratosphere in the altitude range of 15 to 25 kilometers.

**BACKGROUND ART**

Recently, there have been made studies and developments of systems that use an airship kept flying in the stratosphere in the altitude range of 15 to 25 kilometers, in which weather conditions are relatively stable, for the purpose of communication, broadcast, and earth observation. (See patent documents 1 and 2).

Although aircrafts capable of flying in the stratosphere have been developed, technologies that allow humans to stay in the stratosphere for a long period of time have not been known.

**PRIOR ART DOCUMENTS****Patent Documents**

Patent Document 1: Japanese Patent Application Laid-Open No. 2000-95196

Patent Document 2: Japanese Patent Application Laid-Open No. 2001-199397

**SUMMARY OF THE INVENTION****Problems to be Solved by the Invention**

An object of the present invention is to provide a stratospheric stay facility that allows humans to stay in the stratosphere in the altitude range of 15 to 25 kilometers.

**Means for Solving the Problem**

To achieve the above object, the present invention employs the following means.

A stratospheric stay facility according to the present invention comprises:

a structure for stay having a cabin in which an environment in which humans can stay is maintained and having resistance to pressure in an environment at a highest altitude at which the structure for stay is kept flying;

a flying body that is adapted to be capable of ascending to the sky by buoyancy and lifts the structure for stay to keep the structure for stay flying in the stratosphere in the altitude range of 15 to 25 kilometers; and

a mooring member that has a first end fixed to the structure for stay or the flying body and a second end fixed to the earth to moor the structure for stay.

It should be understood that, the expression "a first end fixed to the structure for stay or the flying body" means that the first end of the mooring member may be fixed to the structure for stay or the flying body, or alternatively, to a part that connects the structure for stay and the flying body.

According to the present invention, the structure for stay is kept flying in the stratosphere in the altitude range of 15 to 25 kilometers by the flying body and moored by the mooring member. This enables humans to stay in the cabin of the structure for stay, in which an environment in which humans can stay is maintained. It is sufficient for the structure for stay to be adapted to fly at a desired altitude in the range of 15 to

2

25 kilometers and to have resistance to pressure in the environment at the highest altitude at which the structure for stay is kept flying.

It is preferred that the flying body be adapted to be capable of moving in vertical and horizontal directions and that there be a plurality of flying bodies that pull the structure for stay in different directions to control the position and inclination of the structure for stay.

Controlling the position and inclination of the structure for stay by a plurality of flying bodies enables to maintain a comfortable condition in the cabin.

It is preferred that at least one of a first mooring cable having an end that is fixed to a cable connecting the flying body and the structure for stay and a second mooring cable having an end that is fixed to the structure for stay be used as the mooring member.

It is preferred that the stratospheric stay facility further include a gondola that has a cabin in which an environment in which humans can stay is maintained, has resistance to pressure in an environment at an altitude at which the structure for stay is kept flying, and can move on the second mooring cable between the earth and the structure for stay.

With this configuration, people can move between the earth and the structure for stay using the gondola with the structure for stay left flying in the stratosphere. Therefore, the cost of transporting people to the stratosphere and back to the earth can be reduced.

It is preferred that the stratospheric stay facility further include a flying body for driving the gondola that is adapted to be capable of ascending to the sky by buoyancy and lifts the gondola to move it to the structure for stay.

In some embodiments, it is preferred that the second end of the mooring member be fixed to the ground.

This enables the structure for stay to be kept flying at a nearly constant position.

In some embodiments, it is preferred that the second end of the mooring member be fixed to a ship on the sea.

With this feature, the structure for stay can be moved in the stratosphere, and the position and inclination of the structure for stay can be controlled by moving the ship.

It is preferred that a lift generating part that generates lift be provided on at least one of the structure for stay and the flying body.

With this feature, not only the buoyancy of the flying body but also lift generated by the lift generating part can be utilized as force for lifting the structure for stay. This can lead to a reduction in the number and size of the flying bodies. Moreover, the size of the structure for stay, the maximum weight of the people and baggage on the structure for stay, and the altitude at which the structure for stay is kept flying can be increased more easily.

**Advantageous Effect of the Invention**

As described above, the present invention enables humans to stay in the stratosphere in the altitude range of 15 to 25 kilometers.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a view of a stratospheric stay facility according to a first embodiment of the present invention, seen obliquely from above.

FIG. 2 is a view of the stratospheric stay facility according to the first embodiment of the present invention, seen from above.

3

FIG. 3 illustrates a way of moving a gondola in the stratospheric stay facility according to the first embodiment of the present invention.

FIG. 4 is a diagram illustrating the inner structure of the structure for stay according to the first embodiment of the present invention.

FIG. 5 is a view of a stratospheric stay facility according to a second embodiment of the present invention, seen obliquely from above.

FIG. 6 is a perspective view of a flying body according to a third embodiment of the present invention.

FIG. 7 is a perspective view of a flying body according to a fourth embodiment of the present invention.

FIG. 8 is a perspective view of a flying body according to a fifth embodiment of the present invention.

FIG. 9 illustrates the operation of a lift generating part in the flying body according to the fifth embodiment of the present invention.

#### EMBODIMENTS FOR CARRYING OUT THE INVENTION

In the following, embodiments for carrying out the present invention will be described with reference to the accompanying drawings. The dimensions, materials, shapes, relative arrangements, and other features of the components that will be described in connection with the embodiments are not intended to limit the scope of the present invention only to them, unless particularly stated.

##### First Embodiment

##### Overall Construction of Stratospheric Stay Facility

The overall construction of a stratospheric stay facility according to a first embodiment of the present invention will be described with reference to FIGS. 1 and 2.

It is known that weather conditions are relatively stable in the stratosphere in the altitude range of 15 to 25 kilometers. A stratospheric stay facility **100** according to this embodiment is a facility that allows humans to stay in the stratosphere in the altitude range of 15 to 25 kilometers, in which weather conditions are relatively stable. The stratospheric stay facility **100** includes a structure for stay (or residential structure) **10** and a plurality of airships **20**, which are flying bodies used to keep the structure for stay **10** flying in the stratosphere. The stratospheric stay facility **100** further includes first mooring cables **50** and a second mooring cable **80** as mooring members used to moor the structure for stay **10**. In this embodiment, a case where the altitude of the highest position at which the structure for stay **10** is kept flying is 25 kilometers will be described by way of example.

##### <Structure for Stay>

The structure for stay **10** has, in its interior, a cabin **12** in which an environment allowing humans to stay in it is maintained (see FIG. 4). The structure for stay **10** is provided with equipment that controls the temperature, humidity, and pressure to maintain such an environment (or comfortable environment) in the cabin **12** that is suitable in terms of temperature, humidity, and pressure for humans to stay in it. The structure for stay **10** has a countermeasure against cosmic and ultraviolet rays to prevent people staying in the cabin **12** from being harmfully affected under cosmic and ultraviolet ray conditions in the stratospheric environment in the altitude range of 15 to 25 kilometers (height **H** in FIG. 1). The structure for stay **10** has resistance to pressure at least in the environment at an altitude of 25 kilometers so that it is durable

4

in the stratospheric environment in the altitude range of 15 to 25 kilometers. In cases where the altitude of the highest position at which the structure for stay **10** is kept flying is not 25 kilometers but lower than 25 kilometers, e.g. in cases where the altitude of the highest position is 20 kilometers, it is sufficient that the structure for stay **10** has resistance to pressure at least in the environment at an altitude of 20 kilometers. This also applies to the countermeasure for cosmic and ultraviolet rays.

Known technologies relating to the fuselage of aircrafts that can fly at an altitude of 25 kilometers can be applied to the structure for stay **10** having a cabin **12** in which an environment allowing humans to stay in it is maintained and having pressure resistance in the environment at an altitude of 25 kilometers. A desirable size of the structure for stay **10** is as large as the fuselage of a supersonic aircraft (having a diameter of approximately six meters, a length of approximately 60 meters, and a full three-story structure, for example). The structure for stay **10** according to the embodiment has a plurality of windows **11** provided on the top to allow people staying therein to have a view of the sky.

##### <Flying Body (Airship)>

In this embodiment, four airships **20** are used to lift the structure for stay **10** by cables **40**, thereby keeping the structure for stay **10** flying in the stratosphere in the altitude range of 15 to 25 kilometers. The airships **20** may be known airships that are designed to be capable of flying in the stratosphere. The airship **20** is adapted to be capable of moving in vertical and horizontal directions. The airship **20** need not be provided with facilities inside it that allow a human to stay in it so long as the flight thereof can be controlled. The airship **20** according to the embodiment has a solar cell **21** provided in the top portion so that it can provide all or part of the energy for driving the airship **20**. The gas used to provide the lift (or buoyancy) of the airship **20** may be hydrogen or helium gas. The use of hydrogen gas is desirable from the viewpoint of cost.

The airships **20** are used not only to bring the structure for stay **10** from the ground to the stratosphere and from the stratosphere to the ground but also to control the position and inclination of the structure for stay **10**. In this embodiment, ends of the cables **40** are fixed to the structure for stay **10** at four positions including two front positions and two rear positions, and the other ends (or second ends) of the cables **40** are fixed to the airships **20** respectively, so that the structure of stay **10** is pulled in four directions. This configuration enables control of the position and inclination of the structure for stay **10** by controlling the position of four airships **20** (see FIG. 2).

In this embodiment, the structure for stay **10** is adapted to be pulled from four directions. In order to control the position and inclination of the structure for stay **10**, it is desirable that the structure for stay **10** be pulled from at least three directions. The structure for stay **10** may be pulled from five or more directions. While in this embodiment one flying body (i.e. airship **20**) is used to pull the structure for stay **10** in each direction, two or more flying bodies (airships **20**) may be used to pull the structure for stay **10** in each direction. In the latter case, cables branched from one cable fixed to the structure for stay may be used, and each of the branch cables may be fixed to a flying body (airship **20**).

The flight of each of the plurality of flying bodies (airships **20**) may be controlled by communication or other means from the structure for stay **10** or from the ground.

5

&lt;Mooring Member&gt;

The first mooring cables **50** and the second mooring cable **80** are used as mooring members for mooring the structure for stay **10** in the stratospheric stay facility **100** according to the embodiment.

One end of each first mooring cable **50** is fixed to a cable **40** that connects the airship **20** and the structure for stay **10**, and the other end (or second end) is fixed to a foundation **30** provided on the ground. There are four cables **40**, and one first mooring cable **50** is provided for each of the four cables **40**. The foundations **30** are arranged with an interval (W in FIG. 1) between adjacent foundations **30** of 5 to 30 kilometers. One end of the second mooring cable **80** is fixed to the structure for stay **10**, and the other end (or second end) is fixed to a foundation **70** provided on the ground.

As described above, the structure for stay **10** is moored by the four first mooring cables **50** and one second mooring cable **80**. This arrangement can keep the structure for stay **10** flying at a nearly constant position.

&lt;Means for Transporting Humans&gt;

It is possible to transport humans from the ground to the stratosphere or from the stratosphere to the ground by towing the structure for stay **10** with them aboard by the four airships **20**. However, in the case where the structure for stay **10** is as large as the fuselage of a supersonic aircraft, it is very cost-consuming to move the structure for stay **10** itself frequently by the airships **20**.

In this embodiment, there is provided a gondola **60** that can move on the second mooring cable **80** between the ground and the structure for stay **10**. As with the structure for stay **10**, the gondola **60** has a cabin **61** in which an environment allowing humans to stay in it is maintained and has resistance to pressure in the environment at least at an altitude of 25 kilometers. In cases where the altitude of the highest position at which the structure for stay **10** is kept flying is not 25 kilometers but lower than 25 kilometers, it is sufficient that the gondola **60** has resistance to pressure at least in the environment at an altitude at which the structure for stay **10** is kept flying. This also applies to the countermeasure for cosmic and ultraviolet rays.

The transportation of people using gondola **60** enables to transport them to the structure for stay **10** in the stratosphere and from the structure for stay **10** to the ground while leaving the structure for stay **10** flying in the stratosphere, leading to cost reduction. As means for moving the gondola **60** on the second mooring cable **80**, suitable known technologies may be employed. Here, an exemplary case where small airships are used as flying bodies for driving the gondola will be described with reference to FIG. 3.

In the exemplary case shown in FIG. 3, the gondola **60** is moved up/down by three small airships **90** connected with the gondola **60** by respective cables **62**. The gondola **60** is smaller and lighter in weight as compared to the structure for stay **10**, and it can be moved up/down by the small airships **90**.

When people move from the gondola **60** to the cabin **12** of the structure for stay **10** or from the cabin **12** of the structure for stay **10** to the gondola **60**, it is necessary that they be not exposed to the atmosphere in the stratosphere. To this end, the structure for stay **10** has a pressure adjustment room provided adjacent to the cabin **12**.

In the following, the pressure adjustment room will be described with reference to FIG. 4. FIG. 4 shows the inner structure of the structure for stay **10**. The pressure adjustment room **13** has a first openable/closable door **14** leading to the outside of the structure for stay **10** and a second openable/closable door **15** leading to the cabin **12**. When both the first openable/closable door **14** and second openable/closable

6

door **15** are closed, the pressure adjustment room **13** is a closed space, and the pressure adjustment room **13** is adapted in such a way that the pressure in it is adjustable. When the gondola **60** is brought into the structure for stay **10**, the gondola **60** is brought into the pressure adjustment room **13** with only the first openable/closable door **14** on the outer side being open. Thereafter, the first openable/closable door **14** on the outer side is closed, and the pressure in the pressure adjustment room **13**, which is then a closed space, is adjusted to a pressure under which humans can stay (approximately 1 atm). Thereafter, the second openable/closable door **15** on the cabin **12** side is opened, allowing people to move from the gondola **60** to the cabin **12**. When the gondola **60** is moved from the structure for stay **10** to the ground, the second openable/closable door **15** on the cabin **12** side is closed, and then the first openable/closable door **14** on the outer side is opened.

Alternatively, the gondola **60** and the structure for stay **10** may be connected directly (or docked) with their interior airtightly isolated from the outside atmosphere to allow people to move between the gondola **60** and the structure for stay **10**.

#### Advantages of this Embodiment

The stratospheric stay facility **100** according to this embodiment enables humans to stay in the stratosphere in the altitude range of 15 to 25 kilometers. Controlling the position and inclination of the structure for stay **10** by a plurality of flying bodies (airships **20**) can provide a comfortable environment for stay.

In this embodiment, the structure for stay **10** is provided with windows **11** on its top, and people staying in the structure for stay **10** can have a view of the sky from the stratosphere, because their view of the sky is not obstructed by the airships **20**, as will be seen from FIG. 2. Providing further windows on the sides and bottom of the structure for stay **10** will allow people to have a view of the surface of the earth.

Allowing people to stay for a long period of time, the stratospheric stay facility **100** according to this embodiment can be used for the purpose of earth observation, astronomical observation, and various experiments as well as sightseeing and lodging. It may also be used as a base from/on which manned and unmanned aircrafts take off/alight.

#### Second Embodiment

A stratospheric stay facility according to a second embodiment of the present invention will be described with reference to FIG. 5. While in the above-described first embodiment the second ends of the mooring cables are fixed to the ground, in this embodiment the second ends of the mooring cables are fixed to ships on the sea. The other features are the same as those in the first embodiment, and the same components will be denoted by the same reference numerals and will not be described further.

In the stratosphere stay facility **100a** according to this embodiment, the second ends of the first mooring cables **50** are fixed to ships **35** on the sea, and the second end of the second mooring cable **80** is also fixed to a ship on the sea. The other arrangements are the same as those in the above-described first embodiment.

With the above feature, in this embodiment, the position and inclination of the structure for stay **10** can be controlled by moving the ships **35**, **75** in cooperation with the four

7

airships **20**. In addition, the structure for stay **10** can be moved in the stratosphere by moving the ships **35**, **75** in cooperation with the four airships **20**.

#### Third Embodiment

A flying body according to a third embodiment of the present invention will be described with reference to FIG. 6. While in the above-described first and second embodiments, the flying body (airship) ascends only by the buoyant force, in this embodiment the flying body is provided with lift generating parts. The features other than the flying body are the same as those in the first and second embodiments and will not be described further.

The airship **20a** as a flying body according to this embodiment is provided with wings **22** as lift generating parts. In this embodiment, the wings **22** are provided symmetrically at each of two positions of front and rear to make a total of 4 wings **22**. The construction of the airship **20a** is the same as the airship **20** in the above-described first embodiment except for the provision of the four wings **22**, and the same portions will not be further described.

In this embodiment, the wings **22** are ultralight wings such as inflatable wings. They can be swung in the direction indicated by arrows R in FIG. 6 under control. When the wings **22** are swung in such a way as to directly face the direction of the wind, they can generate lift.

As described above, the airship **20a** as a flying body according to this embodiment can utilize as lifting force lift generated by the wings **22** in addition to the buoyant force. This can increase the force for lifting the aforementioned structure for stay **10** by the airships **20a**. In consequence, the number of the airships **20a** and/or the size of the airships **20a** can be reduced. Moreover, the size of the structure for stay **10**, the maximum weight of the people and baggage on the structure for stay **10**, and the altitude at which the structure for stay **10** is kept flying can be increased more easily. The positions at which the wings **22** are provided and the number of the wings **22** are not limited to those described above.

#### Fourth Embodiment

A flying body according to a fourth embodiment of the present invention will be described with reference to FIG. 7. While in the above-described first and second embodiments, the flying body (airship) ascends only by the buoyant force, in this embodiment the flying body is provided with lift generating parts. The features other than the flying body are the same as those in the first and second embodiments and will not be described further.

The airship **20b** as a flying body according to this embodiment is provided with main wings **23** and ailerons **24** as lift generating parts. In the airship **20a** according to this embodiment, the main wings **23** are provided symmetrically at a central position with respect to the front-rear direction, and the ailerons **24** are provided symmetrically at a front position. The construction of the airship **20b** is the same as the airship **20** in the above-described first embodiment except for the provision of the main wings **23** and ailerons **24**, and the same portions will not be further described.

The wings **23** and the ailerons **24** are ultralight wings such as inflatable wings. The main wings **23** are equipped with propellers **23b** that blow air to the body **23a** of the main wings **23**.

The airship **20b** according to this embodiment having the above-described construction can generate lift by the main wings **23** and the ailerons **24** utilizing natural wind, and in

8

addition it can positively generate lift by blowing air to the main wings **23** by the rotation of the propellers **23b**.

As described above, this embodiment can also achieve the advantageous effects same as the above-described third embodiment. In the case of this embodiment, lift can be generated only by blowing air to the main wings **23** by the rotation of the propellers **23b**, without utilizing natural wind. The ailerons **24** may also be equipped with propellers.

#### Fifth Embodiment

A flying body according to a fifth embodiment of the present invention will be described with reference to FIGS. 8 and 9. While in the above-described first and second embodiments, the flying body (airship) ascends only by the buoyant force, in this embodiment the flying body is provided with lift generating parts. The features other than the flying body are the same as those in the first and second embodiments and will not be described further.

The airship **20c** as a flying body according to this embodiment is provided with ducted fans **25** as lift generating parts. In this embodiment, the ducted fans **25** are provided symmetrically at each of three positions of front, rear, and central to make a total of 6 ducted fans. The construction of the airship **20c** is the same as the airship **20** in the above-described first embodiment except for the provision of the six ducted fans **25**, and the same portions will not be further described.

The ducted fan **25** has a cylindrical part **25a**, a fan **25b** provided in the cylindrical part **25a**, and a support part **25c** that supports the cylindrical part **25a**. The cylindrical part **25a** is supported by the support part **25c** in such a way that it can pivot in the direction indicated by arrows S in FIG. 8 relative to the support part **25c**, and the orientation of the cylindrical part **25a** can be controlled. FIG. 9 illustrates how the orientation of the cylindrical part **25a** is changed.

The airship **20c** according to this embodiment having the above-described construction can generate airflow through the cylindrical parts **25a** by the rotation of the fans **25b**. Thus, the airship **20c** can generate lift by the ducted fans **25** in addition to buoyant force, as force for ascending.

As described above, this embodiment can also achieve the advantageous effects same as the above-described third embodiment. In this embodiment, the direction of lifting force generated by each of the ducted fans **25** can be regulated by controlling the pivoting of the cylindrical part **25a**. This enables control of the inclination of the airship **20c**. The positions at which the ducted fans **25** are provided and the number of the ducted fans **25** are not limited to those described above.

(Others)

While in the embodiments described in the foregoing, the flying bodies used to lift the structure for stay **10** and the flying bodies used to move the gondola **60** up and down are airships, balloons may be used as the flying bodies, alternatively. When balloons are used to lift the structure for stay **10**, they may be provided with various lift generating parts as described in the third, fourth, and fifth embodiments. The flying bodies used to move the gondola **60** up and down can also be provided with lift generating parts.

There is no limitation on the number of flying bodies (airships **20** and/or balloons), so long as they can generate lift that is needed to keep the structure for stay **10** at a desired altitude and can control the position and inclination of the structure for stay **10**. The structure for stay **10** may be lifted not only by airships **20** or not only by balloons but also by airships **20** and balloons.

A flying body may be provided with different types of lift generating parts described in the third to fifth embodiments. For example, an airship may be provided with wings 22 described in the third embodiment and ducted fans described in the fifth embodiment. In this way, the lift generating parts described in these embodiments may be employed in appropriate combinations as desired.

While in the third to fifth embodiments the lift generating parts are provided on the airships serving as flying bodies, the lift generating parts may be provided on the structure for stay 10 described in the first and second embodiments. The lift generating parts may be provided only on the flying bodies or only on the structure for stay 10. Alternatively, the lift generating parts may be provided on both the flying bodies and the structure for stay 10. However, in the case of the lift generating parts described in the third embodiment, it is necessary that the wings 22 face the wind directly in order to generate lift, and therefore it is also necessary to change the orientation of the structure for stay 10. This is not desirable, because a complex system for changing the orientation of the structure for stay 10 is needed. Moreover, since the lift generating parts can make noise, it is desirable that they be provided only on the flying bodies from the viewpoint of comfort for people staying in the structure for stay 10. Moreover, from the viewpoint of maintenance it is preferred that the parts that generate buoyant force or lift be provided on one of them, and it is desirable that the lift generating parts be provided only on the flying bodies.

#### DESCRIPTION OF THE REFERENCE SIGNS

10: structure for stay  
 11: window  
 12: cabin  
 13: pressure adjustment room  
 14: first openable/closable door  
 15: second openable/closable door  
 20, 20a, 20b, 20c: airship  
 21: solar cell  
 22: wing  
 23: main wing  
 23a: body of main wing  
 23b: propeller  
 24: aileron  
 25: ducted fan  
 25a: cylindrical part  
 25b: fan  
 25c: support part  
 30: foundation  
 35: ship  
 40: cable  
 50: mooring cable  
 60: gondola  
 61: cabin  
 62: cable  
 70: foundation  
 75: ship  
 80: mooring cable  
 90: small airship  
 100, 100a: stratospheric stay facility

The invention claimed is:

1. A stratospheric stay facility comprising:

a structure for stay having a cabin in which an internal environment in which humans can stay is maintained and having resistance to pressure in an external environment at a highest altitude at which the structure for stay is kept flying;

a plurality of flying bodies that are adapted to ascend to the sky by buoyancy and lift said structure for stay to keep said structure for stay flying in the stratosphere in the altitude range of 15 to 25 kilometers;

wherein each one of said flying bodies is adapted to move in vertical and horizontal directions, and wherein said plurality of flying bodies pull said structure for stay in different directions to control position and inclination of said structure for stay;

wherein said plurality of flying bodies include three or more flying bodies that are distributed around the periphery of said structure for stay and wherein each of said plurality of flying bodies are each adapted to move independently from each other of said plurality of flying bodies so as to control said position and inclination of the structure for stay by independently controlling said plurality of flying bodies; and

a plurality of mooring members arranged to moor said structure for stay, said plurality of mooring members including a plurality of first mooring cables that each has a first end fixed to a respective connecting cable connecting one of said flying bodies and said structure for stay and a second end fixed to the Earth to moor said structure for stay.

2. A stratospheric stay facility according to claim 1, wherein said plurality of mooring members include a second mooring cable that is fixed to said structure for stay.

3. A stratospheric stay facility according to claim 2, further comprising a gondola that has a cabin in which an internal environment in which humans can stay is maintained, has resistance to pressure in an external environment at an altitude at which said structure for stay is kept flying, and can move on said second mooring cable between the Earth and said structure for stay.

4. A stratospheric stay facility according to claim 3, further comprising another flying body for driving the gondola, wherein said another flying body is adapted to be capable of ascending to the sky by buoyancy and lifts said gondola to move said gondola to said structure for stay.

5. A stratospheric stay facility according to claim 2, wherein said plurality of first mooring cables extend between said connecting cables connecting said flying bodies and said structure for stay and respective ones of a plurality of foundations on the ground or sea and said second mooring cable extends between said structure for stay and another foundation on the ground or sea.

6. A stratospheric stay facility according to claim 5, wherein said plurality of foundations on the ground or sea include an interval between adjacent foundations of at least 5 km.

7. A stratospheric stay facility according to claim 1, wherein said second ends of said first mooring cables are fixed to the ground.

8. A stratospheric stay facility according to claim 1, wherein said second ends of said first mooring cables are each fixed to a ship on a sea.

9. A stratospheric stay facility according to claim 1, wherein a lift generating part that generates lift is provided on at least one of said structure for stay and said flying bodies.

10. A stratospheric stay facility according to claim 1, wherein said plurality of flying bodies are energy powered air ships having independent drives that independently move said air ships.

11. A stratospheric stay facility according to claim 10, wherein said air ships are remotely controlled via a communication device.

## 11

12. A stratospheric stay facility according to claim 10, wherein said independent drives include lift generators.

13. A stratospheric stay facility according to claim 12, wherein said lift generators include propellers or fans.

14. A stratospheric stay facility comprising:

a structure for stay having a cabin in which an internal environment in which humans can stay is maintained and having resistance to pressure in an external environment at a highest altitude at which the structure for stay is kept flying;

a plurality of flying bodies that are adapted to ascend to the sky by buoyancy and lift said structure for stay to keep said structure for stay flying in the stratosphere in the altitude range of 15 to 25 kilometers;

said plurality of flying bodies being distributed around the periphery of said structure for stay and independently connected to said structure for stay, each of said plurality of flying bodies being adapted to move positions independently from each other of said plurality of flying bodies so as to control said position and inclination of the structure for stay by independently controlling positions of said plurality of flying bodies;

said plurality of flying bodies being each connected to said structure for stay via independent connecting cables;

a plurality of mooring members arranged to moor said structure for stay, wherein said plurality of mooring members including a plurality of first mooring members that connect between respective ones of said independent connecting cables and respective ones of a plurality of foundations on the ground or sea and a second mooring member that is fixed to said structure for stay and that connects to another foundation on the ground or sea.

## 12

15. A method of using a stratospheric stay facility, comprising:

a) providing a stratospheric stay facility having:

a structure for stay having a cabin in which an internal environment in which humans can stay is maintained and having resistance to pressure in an external environment at a highest altitude at which the structure for stay is kept flying;

a plurality of flying bodies that are adapted to ascend to the sky by buoyancy and lift said structure for stay to keep said structure for stay flying in the stratosphere in the altitude range of 15 to 25 kilometers;

said plurality of flying bodies each being connected to said structure for stay via independent connecting cables;

a plurality of mooring members arranged to moor said structure for stay, said plurality of mooring members including a plurality of first mooring members connecting between respective ones of said independent connecting cables and respective ones of a plurality of foundations on the ground or sea;

b) having said flying bodies ascend to the sky by buoyancy and lift said structure for stay to the stratosphere in the altitude range of 15 to 25 kilometers;

c) with said structure for stay at said altitude range of 15 to 25 kilometers, having said mooring members moor said structure for stay;

d) said flying bodies being adapted to be capable of moving in vertical and horizontal directions, and having a plurality of said flying bodies pull said structure for stay in different directions to control position and inclination of said structure for stay.

16. The method of claim 15, further including:

providing at least three of said flying bodies distributed around the periphery of said structure for stay and independently connected to said structure for stay via respective ones of said independent connecting cables, and independently controlling positions of said at least three flying bodies.

\* \* \* \* \*